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DISCLOSURE TEXT:

2p. There are two major constraints to today's approaches to packaging high performance semiconductor technology. Regarding thermal dissipation, the total thermal resistance path from the heat source, the chip, to the heat sink sets an upper limit to the amount of power a chip may be allowed to dissipate. This power limit can often limit the circuit speeds the chip can attain. Therefore, circuit performance and, in the case of a computer, machine cycle speed can be improved by improving the thermal dissipation characteristics of the package. Regarding electrical power distribution, the total circuit impedance, both DC and AC, between the power supply and the chip, sets an upper limit to the noise tolerance and the circuit speeds the chip can attain. Therefore, as with thermal dissipation, computer cycle speeds can be

improved by

lowering the package power distribution impedance.

- The present technique addresses both of these issues in the following manner:

1. The chips are back-bonded directly to a copper board or substrate. Recesses would be provided in the copper substrate to accept silicon chips. The chips would be back-bonded into the chip

sites by a conventional Pb Sn eutectic solder bond. The clearance

area around the chip and within the recess would be filled with a

rigid non-electrically conductive material, such as an epoxy resin.

- 2. The copper board acts as a heat sink and is itself cooled

by either an external air stream or by internally circulating water.

- 3. Chip-to-chip signal distribution is accomplished by

building up alternate layers of polyimide insulation and copper

wiring on the board surface. These are photolith-type operations

similar to those used in ceramic substrate processing.

- 4. Power distribution to the chip is accomplished by making

the board-chip connection electrically conductive, serving as one

current path. The other current path is from the face of the chip

via a metallized polyimide decal which is thermo-compression bonded

to both the chip and the board.

- 5. Signal connections between the chip and the board surface

wiring is also accomplished by the same type of decal.

- By these means, an absolutely minimum thermal path from chip to

heat sink is established, and a greatly reduced electrical impedance

is also established. Another feature is that the dielectric constant

of the polyimide insulation the wiring is adjacent to is much lower

than that for alumina ceramics and can significantly lower the capacitive loading and thereby speed up the circuit operation.

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